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# ARA case book

NUMBER 9

U.S. DEPARTMENT OF COMMERCE

AREA REDEVELOPMENT ADMINISTRATION

OCTOBER 1964

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*This study was accomplished by professional consultants under contract to the Area Redevelopment Administration. While ARA assumes no responsibility for the statements and conclusions made in this study, it believes that the problems discussed, and the solutions suggested, may be useful as a direction or indicator of experience to many communities engaged in economic development and redevelopment.*

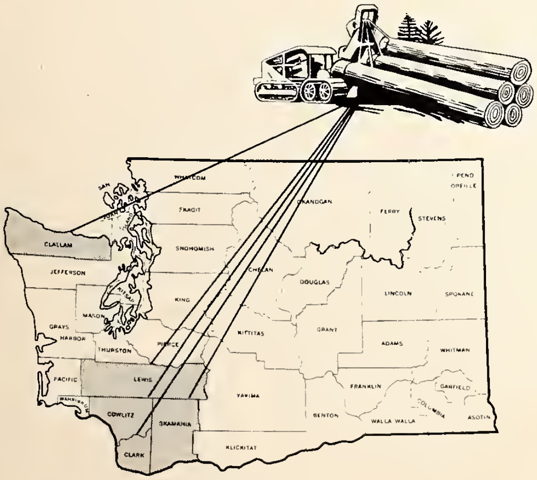
## SUMMARY AND RECOMMENDATIONS

Western Washington State is an important lumber, plywood, and pulp producing region. Five counties in Western Washington were selected as areas that could probably benefit from a study of the economics of utilizing logging residues. Within the five counties selected, four local study areas were examined as possible situations in which to develop an independent business to utilize logging residues.

Various aspects of the local economics of each study area were studied in the field, and are discussed in the report. Ownership patterns, transportation networks, the industrial integration of existing industries, and the current volume of logging residues are generally covered area by area. In the area offering the best combination of factors, a cost analysis of several processes to utilize logging residues is presented.

General economic factors that affect all study areas are mentioned throughout the report. A separate section on general observations that affect certain aspects of utilizing logging residues is presented. Slash burning legislation, selling techniques, mill site location and methods for measuring residues are some of the topics discussed in this section.

It is concluded that the economic feasibility of utilizing logging residues has a great range of opportunity. Depending upon whether conservative or optimistic estimates of prices, costs and yields are used throughout the analysis of a particular area, the economic outlook for an independent business varies from absolutely discouraging to modestly encouraging. A fundamental recommendation of this report is that all parties dealing with a new logging residue business must want such a new venture to succeed. If buyers and sellers, in addition to the new manufacturer, recognize the benefits



Case Book No. 9 – October 1964

### The Economic Feasibility
of
### UTILIZING LOGGING RESIDUES
in Selected
### WASHINGTON COUNTIES

ARA Contract Cc – 6093

Gram Development Corporation
Portland, Oregon

An examination of four areas within five Washington counties to determine feasibility of developing independent businesses utilizing logging residues.

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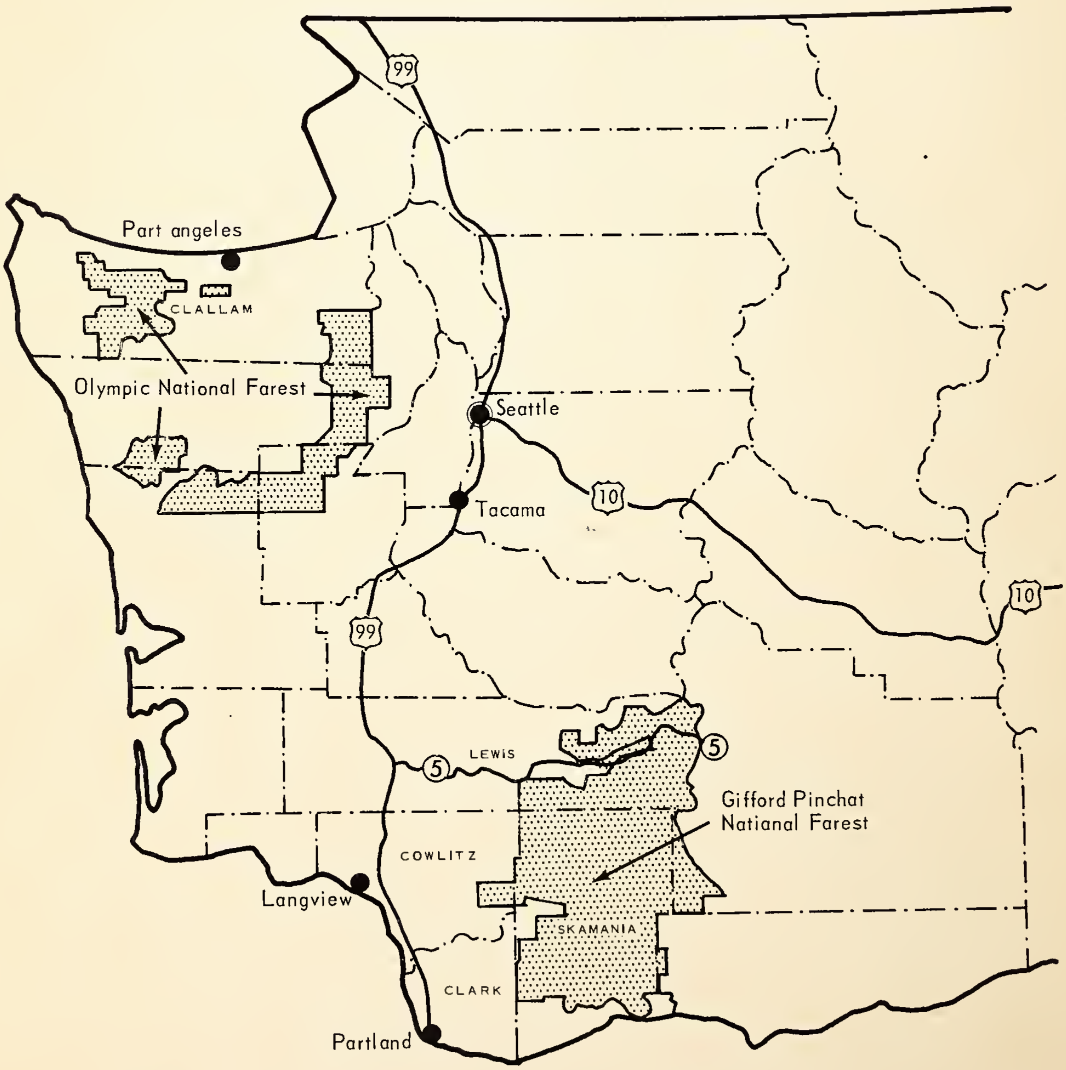
of such conservation, then a business designed to utilize logging residues can succeed.

It is recommended that the following points be considered when analyzing the economic feasibility of utilizing logging residues:

- Be specific about what kind of logging residue is being considered—chippable sound straight small diameter logs, pulpable large diameter logs with white spec rot, etc.
- Determine in what stage of the logging process the specific residue can best be identified for inventory records and for scheduling harvests.
- Study means of forecasting the future occurrence of concentrations of volumes of specific kinds of residues, and how to correlate this with existing inventory records.
- Log the residues at the same time that normal falling, bucking, yarding and loading operations are performed.
- Concentrate efforts to utilize residues in areas where stumpage values are above average; due to either favorable access, transportation, or the proximity of some efficiently integrated forest products industry complex.
- Develop maximum values from logging residues by also making products like lumber, veneer, shake bolts, etc., which have more economic value than raw chips or hog fuel.
- Realize that the full conservation of our resources includes developing the greatest good from all the existing wood, as long as the best silvicultural practices and other long-run safeguards are maintained.

**Figure 1.—WESTERN WASHINGTON STATE**



- Forest owners should provide new methods for selling so-called unmerchantable timber and wood so as to conserve our wood resources, simplify measurement techniques, and reduce administrative cost of the timber sales program.
- Loggers should continue to load and haul all materials on the logging site so long as the direct costs of loading and hauling the material is covered by the sale value of the material.
- Log buyers, by accepting only those logs that can be processed profitably, will actually increase their total supply of logs in the long run through efficient and economical log utilization in their own mill, and by doing this in conjunction with other mills.
- Maintain a vigorous cooperative effort to develop a steady business in one area to utilize logging residues, so that local conditions can mature, and so that other areas can plan by example.

## INTRODUCTION

Forest products industries throughout the United States presently number about 57 thousand establishments. For over 40 thousand of these forest products manufacturing firms, logging constitutes the principal method by which standing timber is harvested and delivered as a raw material to the mill. Approximately 46 percent of the annual timber crop is used for saw logs; 25 percent for pulpwood; 9 percent for veneer logs; and 20 percent by a variety of other industries and consumers. Even though the volume of standing timber harvested annually is large, and there is a variety of markets for the crops, presently it is estimated that as much as one-third of the potentially useable sound wood found in a timber stand must be left on the ground for physical or economic reasons.

This potentially useable but unrecovered portion of the processing loss called logging residue is the general area of concern in this study. When final product volumes of 36.6 billion board feet of lumber, 9.7 billion square feet of plywood, and 26.5 million tons of wood pulp are being developed every year for the United States (value of the final products being over 6 billion dollars), this residual of almost one-third of the original standing tree volume being left in the woods could mean a great deal to the Nation, and to any area fortunate enough to develop ways to minimize such processing losses.

The removal of logging residues will first help to clean up logging sites and conserve our timber resource. Cleaner logging sites are not only aesthetically and recreationally more appealing, but are actually safer, due to the large reduction in fire hazard. Local areas can benefit directly by the removal of logging residues from the increase in timber volume which will be harvested per acre, the lower average cost per unit of wood harvested, and from the possible establishment of a new industry designed to utilize logging residues.

This study utilized all current publications of industry and government in compiling data for the report. Several unpublished sources of data were also incorporated when possible.

## THE VOLUME OF LOGGING RESIDUALS IN SELECTED WASHINGTON COUNTIES

### Washington State

Washington State alone produces about 9 percent of the lumber of the United States, 15 percent of the softwood plywood, and 13 percent of the Nation's wood pulp. Combined with Oregon, which has very similar forest conditions and industry patterns, these two States produce more lumber, plywood and wood pulp than any other comparable area in the world. The opportunity for improving utilization in these areas should have a great frequency in any area with active forest industries like Washington and Oregon, and general comments and observations appropriate in selected areas in Washington may have wide application.

Logging activities in Washington State employed an average of 10.6 thousand people in 1963. All forest products industries in the State employed about 64 thousand people during 1963. Employment in the State's logging industry, and to a lesser extent lumber and plywood, varies greatly with the season of the year; there is a range of employment in all the forest products industries of 27 thousand people from the month with the lowest seasonal average employment to the month with the highest. January is the month of lowest forest industry employment; August the month of highest forest industry employment in Washington State. This seasonal fluctuation is an important aspect of logging that will be discussed in more detail later. Underlying this month-to-month seasonal pattern of changing employment has been the long term regrowth of Washington State's logging industry to support an expanding plywood and pulp industry.

In 1962 the actual log harvest in Washington was reported to be 5 billion board feet. This 1962 harvest was above the ten year average of 4.47 billion board feet for the State. During the past twenty years, only in 1956 did log harvesting reach the same high level as was attained in 1962. In addition to the log harvest being used by forest industries, the well developed and integrated forest products industry was able to use about 3 million units of chips which were salvaged from mill residuals left after processing the regular log harvest. This chip utilization presently supplies about 50 percent of the raw materials for the Washington State pulp industry—the Nation's leading state in pulp production. Current expansions of pulp mill capacity may temporarily cause minor shifts in the concentration of pulp production from one area to another, but the continued long term growth of this steadily expanding industry will continue to put greater demands on the chip supply and raw material base for all areas. The chip market is potentially one of the major markets for logging residuals, and this will be covered to a greater extent under the sections dealing with markets.

### National Forest Log Harvest

The importance of National Forest log harvest is only partially evident in the Washington State log harvest by ownership, as detailed in Table I, Log Harvest in Washington State for 1955 to 1962. As shown in Table I, private forest owners have more timber harvested on their land than any other major ownership group. However, with the variety of individual owners in this group, with the typically short time for cutting, with the small size of many private harvests, and with the impulsive selling of timber by some private owners, the private ownership group shows a greater variation in annual output than do the public ownership groups. Sensitivity of loggers to market conditions, and often marginal timber stands on private holdings, contribute to make annual log harvests more irregular on some private lands in the study areas. Possibly the more important aspect of Table I is that large private ownerships, and the two National Forests in Western Washington State do offer the most opportunity for improvement in utilizing logging residues as studied in this report. Large ownerships with regular timber harvesting plans can best form the even foundation of supply for a new business designed to utilize logging residuals.

### Study Areas

The study areas covered in this report are comprised of five counties in western Washington State. The counties specified for this research study are Clallam, Clark, Cowlitz, Lewis and Skamania Counties. Because these counties contain 34 percent of the annual cut for the State, and therefore will probably continue to dominate the forest industry of the State in the future, and because these counties have mutual problems of supply, industrial development, and markets, the work of this study must consider the combined effects of the region, as well as the specific problem of local development. A comparison of some pertinent characteristics of each of the counties is presented in Table II.

Within the limits of the five county area (Clallam, Clark, Cowlitz, Lewis and Skamania) lie major portions of the Gifford Pinchot and Olympic National Forests. The actual annual cut of these forests is shown in Table I, and the percent of the total commercial forest land of each county that these two National Forests contain is shown in Table II. The importance of such large and uniformly regulated forest properties may be more fully appreciated by studying the map shown in Figure I, Western Washington State. The large private holdings and the two National Forests having a large volume of annual harvest, and harvests being uniformly regulated, do offer good promise for planning improvement in utilizing residues. Because of real differences between large privately owned harvest cuttings as compared with several National Forest operations which are apparent by field inspection, special consideration should be given to the opportunities possible for increasing utilization on National Forest timber sales. If steps are taken to increase utilization, this will have the effect of further conserving our forest resources.

The four timber types shown in Table III, however, account for 95 percent of all the timber in the Gifford Pinchot National Forest. It is not possible at this time to present data which would statistically verify the correctness of the hypothesis that these types are the most defective timber types. From discussions with the United States Forest Service Regional staff members, it is clear that original field data on gross volume and net volume, and thus the percent of natural defect present, is entered on the field tally sheets prepared by the original inventory crews. However, the data has not yet been tabulated and expanded to show what the conditions of natural defect by timber type are on the entire Gifford Pinchot National Forest.

### Inventory Statistics

The recent inventory statistics for the Gifford Pinchot National Forest inventory (1962) presents the best information available on existing timber conditions in the Clark, Cowlitz, Skamania, and Lewis county area. Using this inventory information, and information developed from personal interviews of operating field personnel throughout the National Forests, it was possible to identify the broad timber types that are contributing most to logging residuals left on sites after the harvest cuttings.

Table I

LOG HARVEST IN WASHINGTON STATE
BY MAJOR OWNERSHIPS, 1955–1962

(Volumes in Billions of Board Feet, Scribner Scale)

| | | *National Forests* | | | | |
|---|---|---|---|---|---|---|
| | *Private* | *Gifford Pinchot* | *Olympic* | *Other* | *Public* | *Total* |
| 1962 | 2.9 | .4 | .3 | .8 | .6 | 5.0 |
| 1961 | 2.6 | .4 | .2 | .6 | .6 | 4.4 |
| 1960 | 3.0 | .4 | .3 | .5 | .5 | 4.7 |
| 1959 | 2.8 | .4 | .3 | .7 | .6 | 4.8 |
| 1958 | 2.3 | .3 | .3 | .4 | .5 | 3.8 |
| 1957 | 2.5 | .2 | .2 | .5 | .6 | 4.0 |
| 1956 | 3.3 | .2 | .3 | .4 | .8 | 5.0 |
| 1955 | 3.0 | .2 | .3 | .3 | .7 | 4.5 |

Source: Quarterly Stumpage and Log Supply Report; U.S.F.S. 1963 and Regional Summary of Timber Management Report; U.S.F.S.; 1963.

Some of the recent inventory information for these timber types are presented in Table III.

Supplemental information on estimated defect and breakage allowances used in the Gifford Pinchot inventory are reproduced in Table IV. These allowances would be applied to volume information for sound standing tree volume, and therefore are in addition to the natural defects allowed for in the standing tree (presently untabulated). As an example, should a standing hemlock timber type be perfectly sound, and over 40″ DBH, an allowance of 38 percent would be made in estimating the net volume of this type.

It should be noted that the average diameter distribution of acreages of all stands on the entire Gifford Pinchot reported in the inventory as being 45.8 percent of the land, is in timber over 21 inches. As a most conservative estimate of volumes available on the entire Gifford Pinchot, using the standard defect and breakage allowance for the 20 inch diameter class, by species of timber, the following tabulation gives a general indication of losses due to logging processes (this does not include any allowance for losses of smaller diameter material, and does assume an even distribution of value/acre between young and old stands). The total loss of sound material that could be estimated to occur in large volume concentrations may be 888 million board feet of timber, or 14.7 percent of the large diameter timber stand:

| *Species* | *Estimated Volume Loss from Defect & Breakage* |
|---|---|
| Douglas Fir | 136 Millions of board feet |
| True Firs | 400 Millions of board feet |
| Hemlock | 344 Millions of board feet |

This estimate is a very conservative one of the total residues that develop from one source. There is a great deal of defect that has been

Table II

SELECTED DATA ON WASHINGTON COUNTIES
SPECIFIED AS COMPRISING THE STUDY AREA

| | *Forest Land (Acres)*[1] | *1962 Log Harvest (MMBF)*[2] | *Percent of Forest Land in National Forest* | *1962 Employment in Forest Industries*[3] | *Percent Out-Migration 1950–1960*[4] |
|---|---|---|---|---|---|
| Clallam | 1,036,000 | 230 | 18 | 1,596 | 4 |
| Clark | 243,000 | 75 | ½ | 1,266 | 5 |
| Cowlitz | 657,020 | 412 | 4 | 4,514 | 11 |
| Lewis | 1,213,700 | 545 | 25 | 2,575 | 14 |
| Skamania | 1,035,480 | 430 | 73 | 665 | 3 |
| State Total | | 5,051 | | 42,957 | |

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[1] U.S.F.S. Forest Statistics series for each county (various dates of publication).

[2] Annual Log Harvest Report, Department of Natural Resources, Washington State.

[3] Average monthly employment in Logging, Lumbering and Wood Products Industries (excludes Pulp and Paper) from Employment and Payrolls in Washington State; Washington State Employment Security Dept.; 1962.

[4] Derived from Population Trends in the Pacific Northwest, 1950-1960; BPA.

Table III

STANDING TIMBER INVENTORY ON THE GIFFORD PINCHOT NATIONAL FOREST SHOWING TIMBER TYPES THAT DEVELOP SUBSTANTIAL LOGGING RESIDUES—1962

| *Types* | *Area* | *Average Volume/ Acre* | *Mortality Volume/ Acre* | *Volumes by Species* | | | *Gifford Pinchot Total Volume* |
|---|---|---|---|---|---|---|---|
| | *(Acres)* | *(Board Feet)* | | *DF* | *TF* | *WH* | |
| | | | | *(Millions of Board Feet)* | | | |
| Douglas Fir Young Growth | 375,870 | 42,300 | 173 | 12,594 | 899 | 1,637 | 15,899 |
| Douglas Fir Old Growth | 21,744 | 42,619 | 106 | 726 | 42 | 113 | 927 |
| True Firs | 192,595 | 25,580 | 118 | 541 | 4,955 | 415 | 6,804 |
| Hemlocks | 152,213 | 35,990 | 275 | 1,686 | 27 | 4,252 | 7,030 |
| Total Gifford Pinchot N.F. | 1,029,447 | 31,411 | 139 | 16,046 | 6,800 | 6,594 | 32,336 |

Source: U.S.F.S. Inventory Statistics, Gifford Pinchot National Forest; 1962

allowed for in the standing tree that is useable —an average of 10 percent of the total net volume appears reasonable. Therefore, added to the 888 million board feet is possibly another 3 billion feet of defective material.

General information as discussed above for the Gifford Pinchot National Forest has been developed for the Olympic National Forest. The general indications are:

- Annual cut data for the Olympic National Forest is shown in Table I; the percent of forest area of each county in National Forest is shown in Table II.
- The percent of natural defect existing in the various timber types could be developed from the recent inventory data.
- Inventory data are shown in Table V for the Solduc District of the Olympic National Forest which probably produces the largest volumes of logging residuals available to Port Angeles from a National Forest.
- The estimated defect and breakage allowances used in the timber inventory are similar to those used in the Gifford Pinchot inventory.

Table IV

ALLOWANCE USED FOR HIDDEN DEFECT AND BREAKAGE DEDUCTIONS FOR THREE SPECIES BY DIAMETER CLASSES—GIFFORD PINCHOT NATIONAL FOREST

| | *5" 20"* | *21" and over* [1] |
|---|---|---|
| Douglas Fir | 6% | 11% to 21% |
| True Fir | 9% | 14% to 23% |
| Hemlock | 9% | 18% to 38% |

[1] Exact percent used depends upon the diameter class within this group that may apply: Over 40" trees were given the higher defect and breakage allowance.

These data on Forest Service lands serve only as broad indications of the magnitude of the logging residuals left on sites after logging. And though the discussion has been centered around the National Forests, there are many acres of forest land in Other Public Ownership classifications, and many acres in Private Ownership classes that can offer an opportunity to utilize logging residuals. The fact that the Forest Service does have well developed inventory data that permits some better understanding of existing conditions should not be misinterpreted.

### Logging Residues

Earlier studies of logging residues have been made on all ownerships to discover what volume of logging residuals do remain after logging. In 1930 the U. S. Forest Service reported on logging waste in the Douglas Fir Region ("Logging Waste in the Douglas-fir Region", by A. H. Hodgson, from Pacific Pulp and Paper Industry and West Coast Lumberman; 1930). The Forest Service made another survey in 1944. The last published survey was conducted by the Institute of Forest Products in 1950 (Unused Wood Inventory; Institute of Forest Products; 1950). Comparing the results of these various studies is a practical impossibility because of the many changes in utilization standards, timber cruising standards, and study definitions. It is clear that some material has always been left on the ground after logging; and that for the less informed segment of the population it has caused alarm, and has resulted in a check being made on the status of the residuals found on sites. To some extent, this study is also a current review of what the situation is regarding logging residues.

The question of how much logging residuals are now left on logging sites is only one question examined in this study. Since most previous studies quoted above have concentrated on this matter, it was decided that a brief survey would be sufficient to document the obvious fact that a lot of sound material still remains on sites after logging. The technical details of the sampling technique and measurement standards followed in this study are presented at the end of this report.

**Table V**

**ANNUAL LOG HARVEST BY GRADE OF LOG FROM THE SOLDUC DISTRICT OF THE OLYMPIC NATIONAL FOREST, 1962**

(Volume in Scribner board feet)

| | |
|---|---|
| *DOUGLAS FIR* | 13,848,760 [1] |
| 1 Peeler | 1,290,460 |
| 2 | 1,165,540 |
| 3 | 2,526,600 |
| SFP | 2,034,280 |
| 1 Sawlog | 140,520 |
| 2 | 5,402,600 |
| 3 | 1,288,760 |
| Cull | 72,830 |
| *HEMLOCK* | 16,253,460 [1] |
| Peeler | 797,560 |
| 1 Sawlog | 1,057,890 |
| 2 | 10,601,230 |
| 3 | 3,796,780 |
| Cull | 538,380 |
| *WHITE FIR* | 8,884,510 [1] |
| Peeler | 476,560 |
| 1 Sawlog | 679,530 |
| 2 | 6,003,170 |
| 3 | 1,725,250 |
| Cull | 343,070 |
| *CEDAR* | 2,193,820 [1] |
| Peeler | — |
| Sawlogs | 2,193,820 |
| Cull | 6,190 |
| *SPRUCE* | 1,330,200 [1] |
| Peeler | 2,300 |
| Sawlogs | 1,327,900 |
| Cull | 7,260 |
| *NOBLE FIRS* | 4,240 [1] |
| Peelers | 1,470 |
| 1 Sawlog | — |
| 2 | 2,770 |
| 3 | — |
| Cull | — |
| *PINE* | 120,590 [1] |
| Sawlogs | 120,590 |
| Cull | — |
| TOTAL MERCHANTABLE | 42,635,580 |
| TOTAL CULL | 967,730 |

[1] Species total does not include cull volumes.

Source: Puget Sound Log Scaling Bureau; tabulations summarized.

In general, the details of the field survey of logging residuals conducted in this study corresponded to those used by the Institute of Forest Products survey of 1950. The results of the intensive 1950 survey showed an average of 1,500 cubic feet per acre of useable wood remained on site—the simple 1963 survey showed an average of 1,770 cubic feet per acre of useable wood remained on site. It is believed that on the average, reasonably similar logging conditions exist today as did in 1950. At a 1,500 cubic feet per acre (4 board feet/cubic foot conversion) this means that about 20 percent of the original stand remains on site, as an average estimate. The real opportunity for economically utilizing logging residues on all ownership types, however, does not rest with the average situation as quoted above. It is the extreme, or extraordinary, situation that will best afford the economic opportunity to develop a profitable business for utilizing residue. This occurrence of some extreme concentrations of logging residuals was quite apparent in the field studies conducted for this report.

The fact that there is a very wide range in the volume of useable wood per acre left on site is quite significant. In the limited sample of eight sub plots taken for this study, the lowest volume of residuals per acre found was 316 cubic feet per acre (original stand per acre was 48 MBF); the highest volume of residuals per acre found was 4,264 net cubic feet per acre (original stand per acre was 42 MBF). In the latter instance, the chance for the economic utilization of logging residues is obviously much better than the average. It was observed with the rare case of salvage logging, that it is in these extremely heavy concentrations of logging residues that there is some possibility for performing profitably. Careful consideration for salvage purposes of the particular logging site will be a vital part of any operation designed to utilize logging residues. Much more study of variables, such as timber type, percent defect, percent of volume in understory, terrain, type of logging, time of year logging is to occur, etc., and their correlation with useable wood left on logging sites is needed before an effective forecast can be made of the volume of logging residual that will result on a given site.

In summarizing the supply of timber and the probable supply of logging residuals, several points stand out. First, timber harvesting is carried on extensively in each of the counties in the study area. Second, timber stands cover vast areas with no regard for county boundaries. Third, both the National Forests and large private holdings are major sources of logs, and generally these ownerships offer the best long run opportunity for increasing utilization of logging residues. Fourth, National

Forest harvest cuttings appear to have a greater need for improved utilization of logging residues, due to the presence of operators who do not own the land they log, and due to usually older timber types, rougher topography, and longer transportation from privately owned lands. Fifth, studies of all ownerships show that approximately 1,500 cubic feet per acre of sound wood remains on site, on the average, after logging: this is approximately 10 to 20 percent of the original stand, on the average. Sixth, that the great range in volume of residuals which exists indicates that there are heavy concentrations—this means that extraordinary concentrations can present good opportunities for the profitable utilization of logging residues.

## THE ECONOMIC OUTLOOK FOR UTILIZING LOGGING RESIDUES

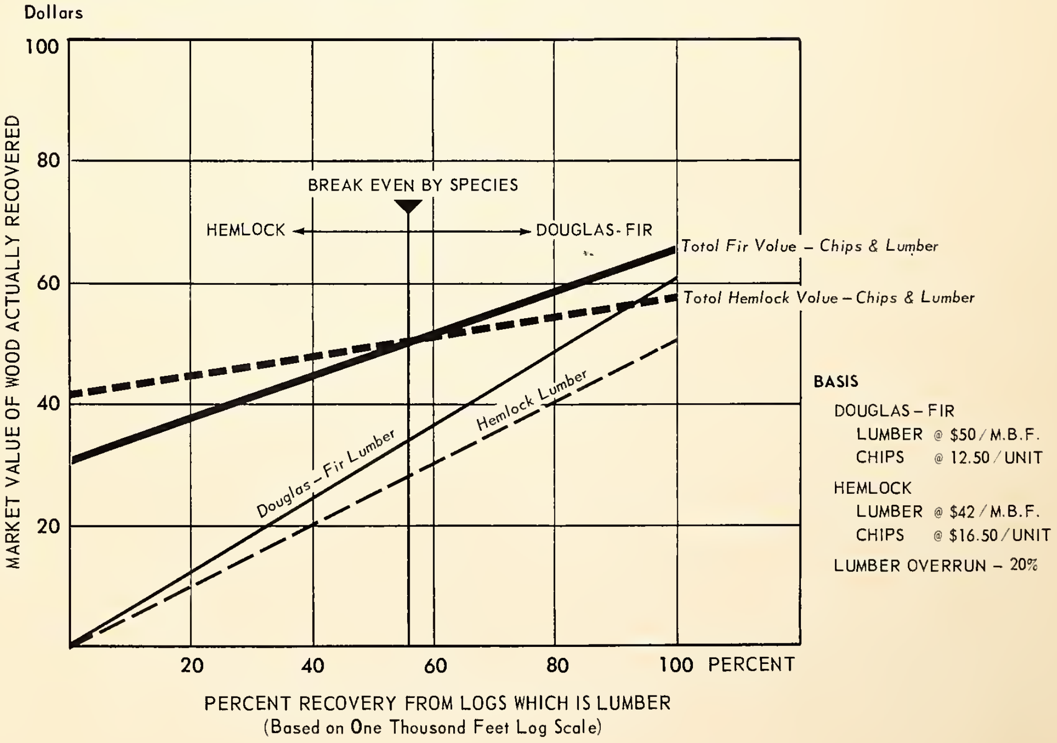
### Today's Forest Industry

The broad aspects of today's forest industry shape some of the significant avenues of development possible for utilizing logging residues. The demand for nearly all products developed from the forest is derived from many manufacturers and processors; which in turn are trying to satisfy the combined demands of consumers or industrial users in many parts of the United States. The quantities and prices for most of the products developed from the forest are set in national or region-wide markets. These markets are competitive markets for standard commodity products. Each producer supplying these markets is relatively small compared to the total market: any one firm contributing less than three percent. The major exception to this broad picture of the forest industry with standard products and nationally fixed prices for each producer, is in the chip market. Special attention will be given the important chip market later in this report.

It should be broadly apparent that the outlook for the economic feasibility of utilizing logging residues does not rest with changing the natural way timber grows. This biologic process has occurred for centuries the same way as it is occurring today. There are no developments with industrial application that exist today that will change the way our trees grow, or that will cause trees to grow in places or in a form so that logging residuals will not result from harvesting. It is concluded that the basic process on the supply side of the economic picture is not apt to change in the foreseeable future.

On the other end of the economic process, the marketing end or demand side of the picture, there appears little hope that established market patterns for primary products are likely to

ESTIMATED DOLLAR RETURNS FROM CONVERTING LOGS TO LUMBER AND CHIPS



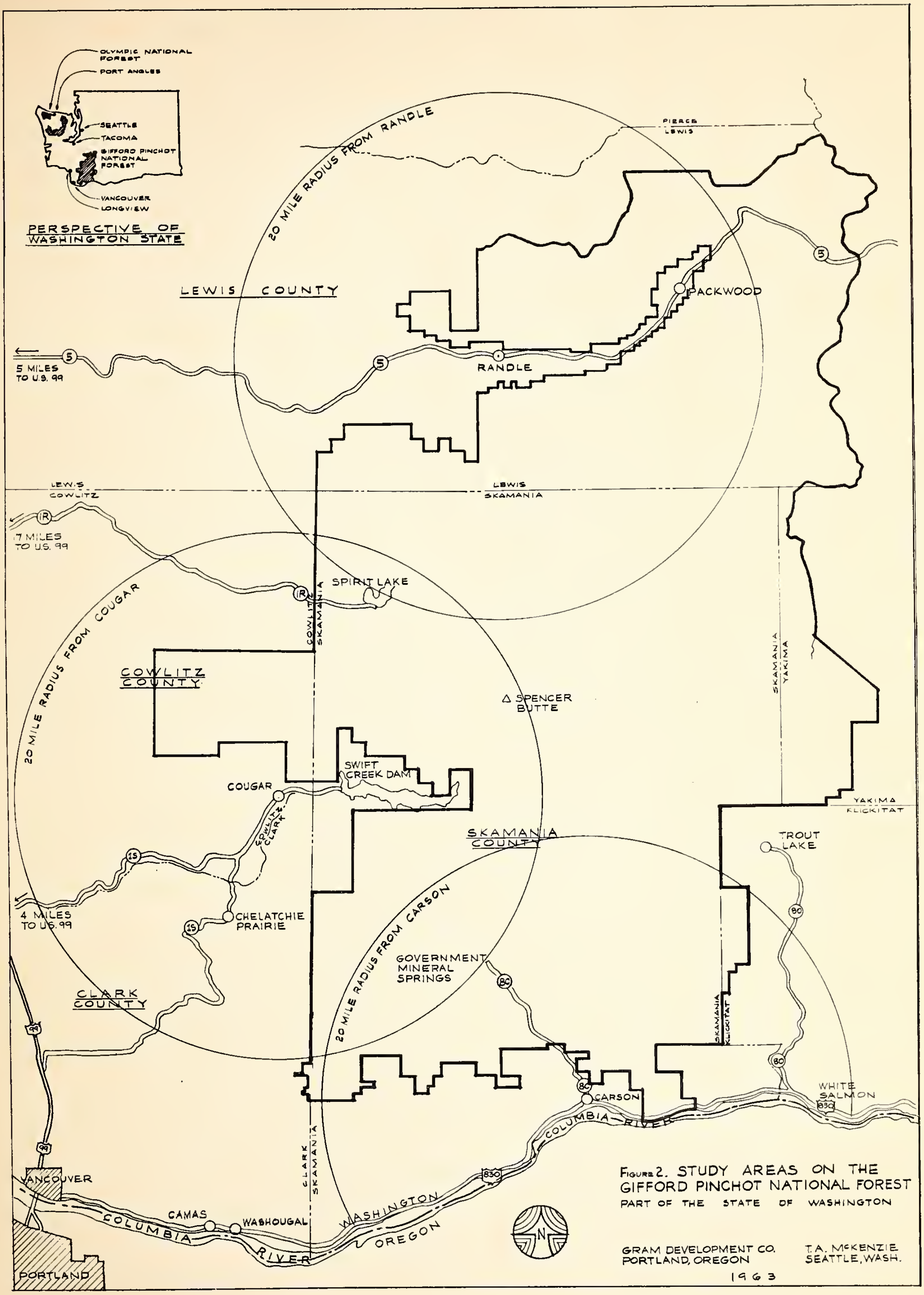


Figure 2. STUDY AREAS ON THE GIFFORD PINCHOT NATIONAL FOREST
PART OF THE STATE OF WASHINGTON

GRAM DEVELOPMENT CO.
PORTLAND, OREGON

T.A. McKENZIE
SEATTLE, WASH.

1963

be upset by efforts to utilize logging residues. The long run timber supply of Western Washington appears sufficient (Timber Trends in Western Oregon and Washington; Pacific Northwest Forest and Range Experiment Station; 1963); and the patterns of industrial change among processes using logs in the forest economy appear to be established. Growth of the pulp manufacturing and the fiber-using segment of the economy is evident. However, no radically new volume product based on logging residues has been created in Research and Development departments. It is therefore concluded that markets for logging residues, and the markets for products manufactured from logging residues are most likely to be the standard commodity product markets that already exist. Prices of these standard commodities are subject to competitive forces in national markets.

As mentioned earlier, the major exception to the national market for most forest products is with chip markets. Chip markets are generally local markets created by pulp mill locations, and buyers and sellers do not operate in an economically competitively manner, in that prices are usually confidential and individually negotiated. However, chips are only one source of raw wood fiber for pulp. Additional supplies of wood fiber for pulp can be developed by extending the outer boundaries of supply through transportation cost-sharing programs with chip haulers; additional wood fiber can be developed directly from using more round-wood (competing for round wood with lumber mills, etc.); additional wood fiber can be developed by using a percentage of planer shavings and sawdust which are now a cost to manufacturers to dispose of as waste; additional wood fiber needs can be reduced by increasing the pulp yields per ton of raw material input. In the final analysis the pulp companies, local as well as international, will decide how to develop additional wood fiber to meet their needs of expanded plant capacity on the basis of the greatest return for each dollar invested. For instance, will a dollar spent in a cost-sharing program on transportation produce more wood fiber for the mill than a dollar spent for plant improvements in order to modify the process to utilize sawdust?

In this fight to meet the raw material needs of an expanding pulp industry, each segment of business capable of helping in the struggle vies for a share of future expenditures to meet fiber needs. It is in the light of such competition that a landowner saddled with obvious quantities of logging residuals finds himself. Either these logging residues must be made economically available so that they can be processed into chips profitably, or the use of logging residuals will have to wait until they become the next cheapest source of wood fiber for the pulp market.

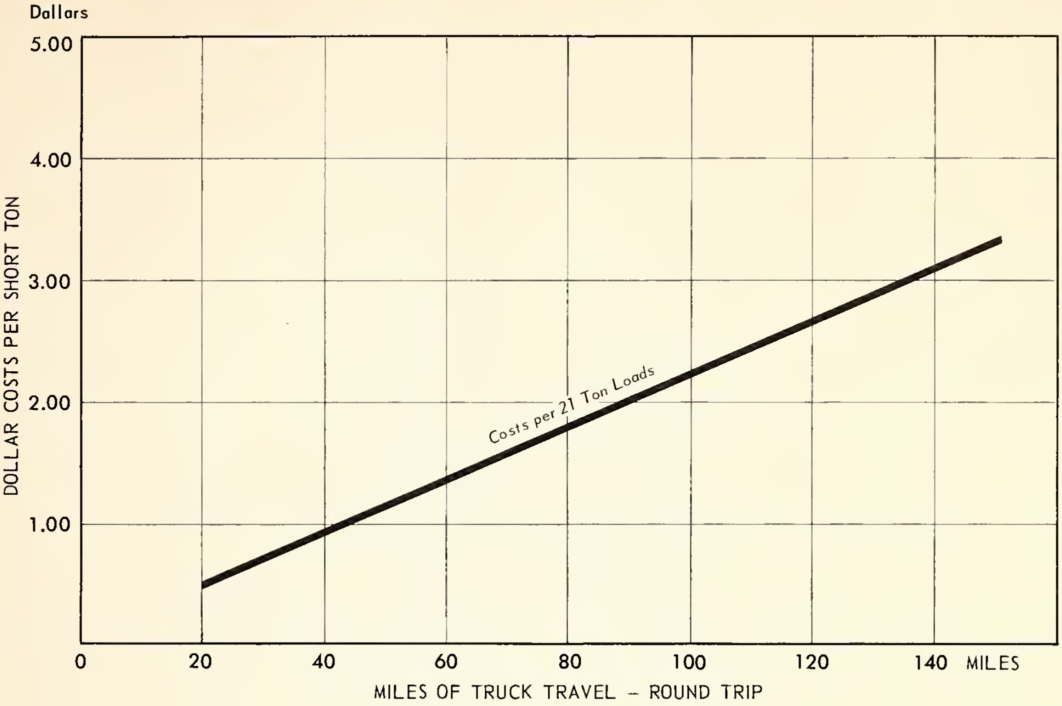
### General Conclusions

The general conclusion of this report is that the problem of economically utilizing logging residues rests in organizing existing forest materials, transportation and manufacturing processes, to make usual forest product commodities. In short, developing special new business patterns in an established industry. This opportunity to specialize within a large established industry is nothing new itself, but if successful on a large scale it would be a new and important step in the field of conservation in the Pacific Northwest.

The historical development of the forest industry in the Northwest and in the Study Area presents certain aspects that bear directly on this study. As stated in Timber Trends in Western Oregon and Western Washington (U.S.F.S. Research Paper 5; 1963); "The industry is pushing eastward onto long-inaccessible Cascade slopes and locally into other spots which, until recently, were remote. In this process, the National Forests have been, for the first time, generally and rapidly brought into production." In addition to ownership, the rugged topography and the consequently limited transportation networks within the study area play a distinct part in favoring certain localities for economic development. It is for these practical reasons that the study area was subdivided into four timbersheds. Three of these timbersheds are best studied by referring to the map shown in Figure 2. The fourth area is the Clallam County area around Port Angeles. Each area will be discussed separately.

The following sections on each economic area have been organized to give a general picture of the situation as it existed in 1963. In 1963 it appeared that the Couger Area offered the best opportunity for development. Each area, however, has particular advantages and disadvantages. In no area is the economic utilization of logging residues clearly a good, safe and independent business opportunity. Because the natural aptitudes of people differ, and also because of the many intricate combinations of local knowledge, good will, weather, etc., the judgments and analysis presented here can never be final in evaluating the business opportunities in an area. However, in light of the situations observed in the field during 1963, and using the data gathered for this study, general conclusions have been reached. It is optimistically hoped that all observations, all data, and all conclusions may be of some value to the reader. The final section of this report is an attempt to anticipate important changes that can affect the conclusions of this study and to

ESTIMATED COST PER UNIT FOR TRUCKING TONNAGE
VARIOUS LENGTH HAULS



suggest one or two new changes that may accelerate developments toward the more complete conservation of our natural resources.

### Port Angeles Area

The Port Angeles area forest products industries are heavily dependent upon private timber for their log supply. Only about 33 percent of Clallam County's 258 million board foot annual harvest has been from Forest Service ownerships over the past 14 years. This is a distinct contrast with the three other study areas where Forest Service harvests are a major source of timber, sometimes amounting to over 90 percent of the log supply for the local area. The ownership of timber, resulting in an accumulation of logging residuals after harvest, is an important consideration in discussing the economic feasibility of utilizing such residues. The incentives for increasing utilization, and how these incentives vary depending upon who owns the wood cannot be overlooked.

In the Port Angeles area large private owners predominate in timber harvest harvesting activities. A required volume production of logs and low average costs per unit of output, is the guiding policy for these large timber operators. Efforts to utilize more logging residues would involve small diameter logs, short lengths, crooked logs and broken pieces. All of this will increase the number of units of wood per acre removed, but this also increases costs of operation per acre, and so raises the average cost per unit of output. Though the objective of getting more volume per acre may be in line with company policy, the subsequent increase in cost per unit of output is definitely not. If there is any other source of equal cost or cheaper wood, such as moving to another acre of standing old growth timber, then this alternative would probably offer the most economic incentive to the large timber operator. Since it was estimated by local foresters and loggers, that almost 25 percent of the annual harvest is exported out of the county, there appears little incentive for large private owners to utilize logging residuals.

Even the Olympic National Forests in the Clallam County area probably suffer from under-utilization of their timber resources. An administration being faced with a calculated and projected annual allowable cut, methodically converting old growth decadent forests into vigorous forests, must deploy a limited staff so as to post for sale the scheduled annual harvest. In a sense, a required volume of timber sales and at low average costs per unit of output is also the guiding policy for the administrative staff of a National Forest. Efforts to utilize more logging residues would involve special sales considerations under current sales procedure, closer sales supervision, and possibly a greater number of sales contracts. All of this would increase the number of units of wood per acre removed, but this also demands more administrative time and personnel per acre sold, and so raises the average cost per unit for output sold. Though the objective of getting greater conservation per acre is in line with National Forest policies, the subsequent increase in the cost per unit of output sold is not. It seems that forests managed by the government in the interest of the public welfare must consider long range benefits in addition to minimum average operating costs per unit of output. In the last section of this report, more will be said about possible ways to keep down costs per unit of output sold, and more will be said about what ways conservation would be better served even if it raised the average operating cost per unit slightly.

The overall opportunity for utilizing logging residues in the Port Angeles area appears to be poor. There seems to be insufficient industrial capacity located in Clallam County to justify higher than average stumpage values (Region 6, 1962 annual average stumpage being $24.80/MBF for Douglas-fir; Hemlock average $8.90/MBF; or the average for all species in Western Washington for 14 consecutive quarters being $21.07/MBF). Average stumpage values for the year in the Port Angeles area were approximately $17.00 per thousand board feet log scale, even though this reflects only the more competitive segment of the log market—that portion which depends upon open market buying of timber and logs.

The industrial complex of Port Angeles area includes four pulp mills, a half dozen small sawmills and two plywood plants. Only the pulp companies, one sawmill and one plywood plant own significant acreages of forest land. Sawmills in the Port Angeles area without sufficient company owned timber must actively compete for logs with buyers for overseas markets, as well as buyers for other mills on Puget Sound. Sawtimber, with most grades of logs, is valued roughly at $4 per thousand less than the going price for similar grades of logs in the active markets in Puget Sound (the approximate cost of rating and towing from Port Angeles to other utilization centers).

Pulpwood is a low value commodity that cannot be shipped economically very far to competing pulpmills; consequently pulpwood is used heavily in the older pulp mills of Port Angeles (that presently cannot handle chips efficiently) for almost 60 percent of their input. By contrast, the Longview area used only 25 percent pulpwood during 1962. Though the pulp mills in the Port Angeles area are expected to modernize so as to accommodate chip input efficiently, this will probably have no favorable effect on the utilization of logging residuals in the Port Angeles area. Annual pulp production of the mills in the Port Angeles area total an average of about 440,000 tons; this means there could be a chip requirement of over 500,000 units of green chips per year. Since the normal sawmill output of chips from installed capacity is not likely to exceed 100,000 units per year, it is probable that chips will continue to be imported into the Port Angeles area, while low value logging residues of the area continue to be unprofitable to utilize. Currently over 35 percent of the chip supply for the Port Angeles area and over 20 percent of the pulp log supply comes from outside of Clallam and Jefferson counties. As few as 60 individual suppliers meet the needs of the pulp mills in the Port Angeles area, as compared with almost 300 in Cowlitz County and over 600 in the Snohomish area.

### Randle-Packwood Area

The Randle-Packwood area industries are dependent heavily upon Forest Service timber being logged in the upper Cascades. A major share of the saw logs harvested annually are processed locally in sawmills and plywood plants. Veneer logs are also processed in Randle. All types of plants in the immediate area have a combined annual log requirement of about 190 million board feet. Possibly 12 million board feet of logs were trucked out of the area to ports for overseas export markets in 1963. In 1962, another 12 million board feet of logs were marketed as cull logs—part being sawn locally, but most logs being sold as pulp logs outside of the area. More complete data on the various log grades by species developed from the 1962 Forest Service harvest is shown in Table VI. Even though Forest Service harvests represented only 26 percent of the 1962 harvest for the entire county, the Forest Service timber does appear to offer the best commercial opportunity for economically utilizing logging residues from the Randle-Packwood area.

All products from the forest must be trucked out of the Randle-Packwood area over State Highway 5. Truck distances from Randle to major markets are about 70 miles, and equal whether products go north to Tacoma or south to Longview (Pulp mills and port facilities are located in both cities). Presently the state limits highway loads on State Highway 5 to 68,000 pounds gross vehicle weight, but this may change when a new bridge is constructed between Randle and Mayfield.

Table VI

ANNUAL LOG HARVEST BY GRADE OF LOG FROM THE RANDLE-PACKWOOD DISTRICT OF THE GIFFORD PINCHOT NATIONAL FOREST, 1962

| | *Total Area (2)* | *Packwood (33 sales)* | *Randle (23 sales)* |
|---|---|---|---|
| Annual Total | 139,757,700 | 85,743,820[2] | 54,013,880[2] |
| Merchantable | 127,834,960 | 77,354,500 | 50,480,460 |
| Cull | 11,922,740 | 8,389,320 | 3,533,420 |
| Douglas Fir | 65,611,350 | 34,668,110[1] | 28,183,730[1] |
| 1 Peeler | 3,421,310 | 1,221,410 | 2,199,900 |
| 2 " | 4,177,640 | 1,637,790 | 2,539,850 |
| 3 " | 14,248,780 | 6,470,590 | 7,778,190 |
| SFP | 1,739,630 | 847,030 | 892,600 |
| 1 Sawlog | 25,200 | 4,090 | 21,110 |
| 2 " | 29,811,910 | 18,186,080 | 11,625,830 |
| 3 " | 9,427,370 | 6,301,120 | 3,126,250 |
| Culls | 2,759,510 | 1,120,160 | 1,639,350 |
| Hemlock | 33,065,750 | 12,741,410[1] | 12,657,440[1] |
| Peelers | 345,170 | 52,400 | 292,770 |
| 1 Sawlog | 524,530 | 125,130 | 399,400 |
| 2 " | 14,796,310 | 7,104,500 | 7,691,810 |
| 3 " | 9,732,840 | 5,459,380 | 4,273,460 |
| Culls | 7,666,900 | 6,065,590 | 1,601,310 |
| White Fir | 26,213,100 | 13,873,510[1] | 5,381,440[1] |
| Peelers | 252,180 | 59,120 | 193,060 |
| 1 Sawlog | 243,190 | 144,590 | 98,600 |
| 2 " | 11,282,140 | 8,602,800 | 2,679,340 |
| 3 " | 7,477,440 | 5,067,000 | 2,410,440 |
| Culls | 958,150 | 761,130 | 197,020 |
| Cedar | 7,739,980 | 4,542,190[1] | 2,965,450[1] |
| Culls | 232,340 | 172,250 | 60,090 |
| Spruce | 34,450 | 33,580 | 870 |
| Pine | 1,917,110 | 1,132,800[1] | 721,000[1] |
| Culls | 63,310 | 36,120 | 27,190 |
| Noble Fir | 10,325,090 | 9,606,170[1] | 501,550[1] |
| Peelers | 1,076,720 | 895,630 | 181,090 |
| 1 Sawlog | 1,528,420 | 1,442,370 | 86,050 |
| 2 " | 6,602,380 | 6,404,140 | 198,240 |
| 3 " | 900,200 | 864,030 | 36,170 |
| Culls | 217,370 | 210,200 | 7,170 |
| Miscellaneous | 850,870 | 756,730[1] | 68,980[1] |
| Culls | 25,160 | 23,870 | 1,290 |

[1] Does not include cull volumes
[2] Includes cull volumes
Source: Puget Sound Log Scaling Bureau; tabulation summarized.

The overall situation for utilizing logging residues in the Randle-Packwood area appears only fair. There seems to be insufficient industrial integration right in the towns of Randle and Packwood to justify higher than average stumpage values (Region 6, 1962 annunal average stumpage being $24.80/MBF for Douglas-fir; Hemlock averaged $8.90/MBF; or the average for all species in Western Washington for 14 consecutive quarters being $21.07/MBF). The processing of logs close to the place where they grow in order to reduce the amount of waste material needlessly hauled is a fundamental concept governing the location of mills in the towns of Randle and Packwood. However, the required 70 mile truck haul from Randle to reach a major utilization or distribution center for most products reduces the allowance for stumpage. Average stumpage values for the year in the Randle-Packwood area were below $17 per thousand board feet log scale in 1962. With a small abundance of lower grade logs, and no local industries adequately integrated to develop maximum value per log, increased utilization appears marginal in the Randle-Packwood area.

Observations of actual industry practice in the Randle-Packwood area began in the timber stands. As the scheduled timber harvest program proceeds, more high elevation forests will be cut. This schedule means more defective timber stands (Hemlock, mostly), higher road costs, and shorter logging seasons will be the trend.

At the log landing where the loading of the logs takes place, observations were made. It was apparent in the Randle-Packwood area that there was a necessity for extensive woods sorting of logs—as many as eight sorts were made as the trucks were waiting for loads. Full truck loads of special, or single use logs is common practice because there is inadequate integration of local industry. Only the highest value logs of a type can be trucked long distances to special manufacturers; only the right type of lower value log is desired by the local firms with their limited integration. The inefficient sorting of logs in the woods, and the high costs of trucking resulting from extended waiting periods for loading is apparently due, in part, to the fact that Randle-Packwood is a small timbershed which is tributary to several other large log buying centers. Combined with the size of the timbershed is the effect of a limited number of independent mill operators competing only mildly for publicly owned timber. As a general statement, the net result is that only minimum capital investment mills, with low capacity, and which produce only economically transportable commodity products, from logs left over from region-wide market sorting of timber, can profitably operate in the Randle-Packwood area.

### Wind River-Carson Area

The Wind River-Carson area industries are also dependent heavily upon Forest Service timber being logged in the upper Cascades. The logs harvested from the forests of the Wind River-Carson area are trucked about thirty miles if destined to a local plant for primary manufacture. Logs from harvests south of the Columbia River are also a significant portion of the timber supply for the industries in the Wind River-Carson area.

Plants in the immediate Wind River-Carson area have an annual log requirement of about 190 million board feet. The annual log harvest in Skamania, Clark, Multnomah and Mount Hood counties totals over 800 million board feet. Even though all the logs harvested in each of these four adjoining counties does not remain in those counties for processing, two points may be surmised. First, there probably is sufficient log harvest for existing capacity located in the Wind River-Carson area. Second, there must be enough acres logged each year to furnish a reasonably good situation in which to use some areas as supply for a logging residues plant.

The overall prospect for utilizing logging residues in the Wind River-Carson area appears fairly good. There appears to be sufficient industrial integration of individual mills in the area, and in combination with the pulp companies downstream on the Columbia River. This integration and location of mills does justify the higher than average stumpage values which prevail. The average annual stumpage received for all species combined on the Hemlock District of the Gifford Pinchot National Forest in 1962 was $25.53/MBF—more than four dollars per thousand above the Western Washington Regional average ($21.07).

High stumpage values earmark those areas where the wood growing on a site has great economic significance; either because the quality of the timber is better, or because the mills processing the timber are more efficient, or because the location is more economically accessible. The combined effect of all these factors are possible. In the Wind River-Carson area, higher than average stumpage values do exist. In this area the timber quality is judged to be of lesser importance in holding up stumpage values than is the influence of modern mills, or of locational advantages. Timber grown north of a central point called Spencer Butte (see Figure 1 for map) is accessible to all markets surrounding the National Forest; and since this means nearly half of the timber area and various timber qualities on the Gifford Pinchot can be profitably processed through the Wind River-Carson area, it also reinforces the judgment that timber quality of logs processed in the Wind River area is not too different as compared to other areas. The higher than average stumpage values, which appear to be influenced by factors other than timber quality, will also tend to increase the values of the logging residues left on sites in the Wind River-Carson area. This economic fact cannot be ignored.

Observations of actual industry practice in the Wind River-Carson area included a brief field study of the timber stands. As the scheduled timber harvest program on the National Forest proceeds, more high elevation forests and old growth forests will be cut. Old growth Hemlock stands are particularly defective in the Wind River area, as are most stands over 180 years of age. This schedule of timber harvesting will mean a continuing harvest of defective timber stands, and an increase in the amount of high lead logging (which creates more logging residuals than other logging methods).

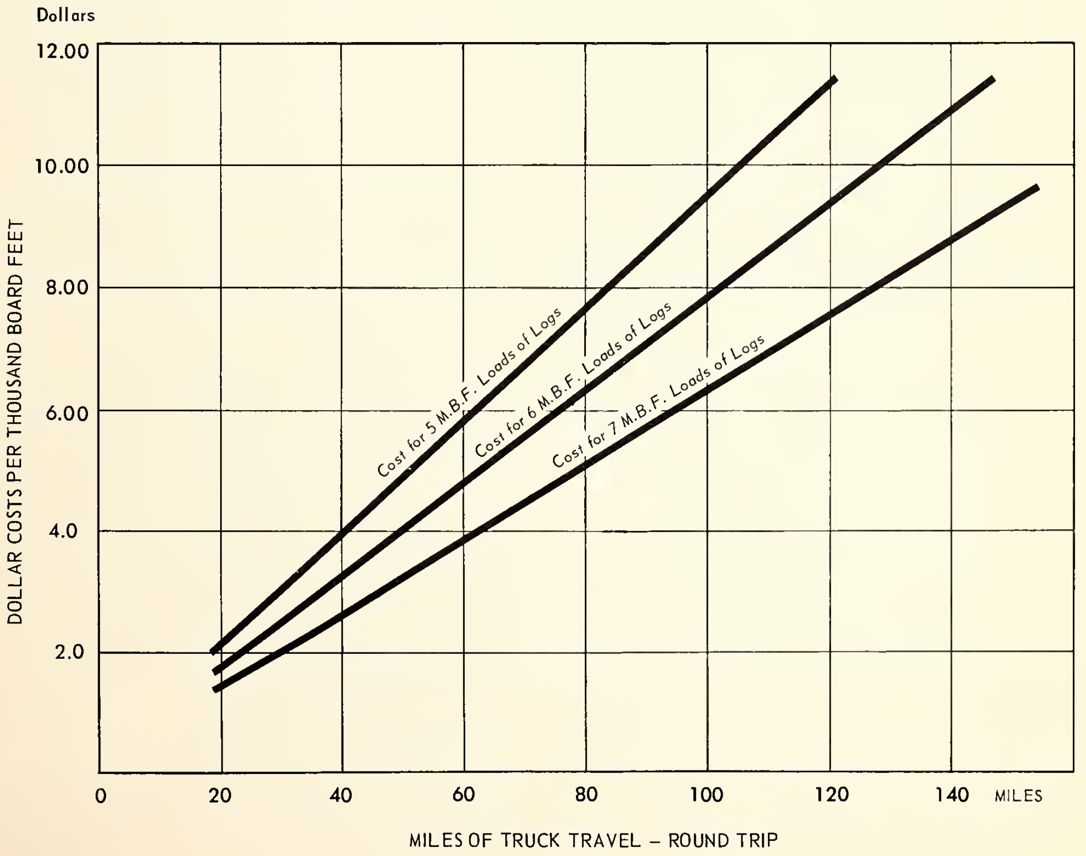
As for the grade of logs actually recovered: the Columbia River Scaling Bureau generally handles the grading of logs harvested from the National Forest in the Wind River-Carson area. Because of differences in tabulating procedures and operating policies between this area and the Puget Sound area no detailed information (like Table VI) can be presented for the Wind River-Carson area. General estimates by foresters indicate that grade recovery varies most between two age classes of timber. For young growth timber an average stand of 55 MBF net per acre total is to be expected. The average diameter (breast high) will be Peeler grade;

75 percent in #2 Sawlog grade; 23 percent in #3 Sawlog grade. The other age class is called old growth (over 180 years) and is estimated to have the following characteristics: net volume per acre is 45 MBF; average diameter 32 inches; grade recovery is 10 percent Peeler grade, 60 percent #2 Sawlog grade; and 30 percent #3 Sawlog grade.

Observations of log loading, scaling and log storage practices were made in the Wind River-Carson area. It was apparent that there was some woods sorting of logs. However, the ability of local mills to utilize a wide range of log grades, or sort out certain grades of logs in the water and raft for open market selling was noticeable. Also apparent was the current use of mobile yarding and loading equipment, which would be necessary for utilizing logging residues.

Observations of the existing forest products industries in the Wind River-Carson area were made. Several outstanding developments were in evidence: a new plywood plant has recently been built with firm plans for a new sawmill; a modern new automatic lumber sorter has been installed; a woods located breakdown mill with a flume for transporting cants to a railroad location for remanufacturing and finishing is operating successfully. Rail, truck and barge transportation are available at nearly all industrial sites. The proximity of one large and versatile pulp company within 40 miles, and other pulp mills within a reasonable distance, has enabled industries to develop maximum yields from all logs processed. In fact, logging residues are also profitably utilized when shortages in chip supply warrant additional supplies of pulpwood. As a general statement of economic conditions in the Wind River-Carson area, there appears to be good reasons now in force for making substantial capital investments in plant modernization and expansion. The question of forecasting what will be the location of sites with abundant logging residues is the next problem of practical significance in evaluating the costs and returns of a capital investment in a plant to utilize logging residues from the Wind River-Carson area. Whether it is possible and more economic to locate a proposed mill site near the new sources of logging

ESTIMATED COST PER UNIT FOR TRUCKING LOGS
VARIOUS LENGTH HAULS



residues (if adequately concentrated, etc.), or whether it is more economic to haul low value logs to a site on the Columbia River (and thus have better finish product shipping alternatives) is the critical unanswered question in the Wind River-Carson area.

## COUGAR STUDY AREA

### General Description

The general description of the Cougar area is not a center of forest industry as are the Randle-Packwood and Wind River-Carson areas. The industries for manufacturing both primary and finish products from logs harvested from the Cougar area are located along U. S. Highway 99 and on both sides of the Columbia River, from Portland to Centralia and Cathlamet; with Longview being more or less the focus of activity. The mills around Longview are a major concentration of forest products industries in the State of Washington.

The Cougar area discussed in this study forms the eastern segment of the large timbershed which supplies the many industries clustered about Longview. Over half of the logs harvested in this broad eastern part of the timbershed come from lands in private ownership. However, using Cougar as an approximate locality through which much of the regularly harvested timber supply must pass, practical conclusions can be developed about utilizing logging residues for several reasons. First the logs harvested around Cougar are nearly all from lands in public ownership, which does generally offer to independent companies the best opportunity to increase utilization. Second, there always is a need to reduce the distance that low value logs must be transported before they are processed into higher value commodities that can better bear the costs of transportation; a Cougar location could offer this opportunity.

By referring to Figure 2, the location of Cougar in Cowlitz County, but near the edge of Skamania County, can be appreciated. These two counties are ranked as the second and fourth largest timber producing counties in the state. It is estimated that about half of the 430 million board feet of logs harvested in Skamania county in 1962 were cut within a twenty mile radius from Cougar. And although Cowlitz County's log harvest is over 85 percent from private lands, there is probably a significant proportion of that 412 million board feet annual harvest which was also cut within a twenty mile radius from Cougar. It can be concluded that the area around Cougar probably has the largest annual log harvest of any of the areas examined in this study, and thus the greatest number of logging sites to choose from when considering supplies of logging residue.

The overall situation for utilizing logging residues in the Cougar area appears to be the best of the four study areas examined. There is good industrial integration of mills dependent on the timber from this part of the Gifford Pinchot National Forest so that higher than average stumpage values prevail. The 1962 average annual stumpage received for all species combined on the Canyon Creek and Lewis River Districts was $21.80/MBF—almost a dollar above the Western Washington Regional average ($21.07/MBF).

High stumpage values earmark those areas where the wood growing on a site has great economic significance; either because the quality of the timber is better, or because the mills processing the timber are more efficient, or because the location is more economically accessible. The combined effect of all these factors is possible. In the Cougar area, higher than average stumpage values do exist. In this area the timber quality is judged to be of lesser importance in maintaining stumpage values than is the influence of modern mills, or of locational advantages. Timber grown north of a central point called Spencer Butte (see Figure 2 for map) is accessible to all markets surrounding the National Forest; and since this means nearly half of the timber area and various timber qualities on the Gifford Pinchot can be profitably processed through the Cougar area, it also reinforces the judgment that timber quality of logs processed is not too different in the Cougar area as compared to other areas. The higher than average stumpage values, which appear to be influenced by factors other than timber quality, will also tend to increase the values of the logging residues left on sites in the Cougar area. This economic factor cannot be ignored.

Observations of actual industry practice in the Cougar area included a field study of some of the timber stands. From discussions with field foresters and loggers, and from actual field measurements it was concluded that defective timber stands would continue to form an increasingly important part of the future timber harvest of the area. Road development and road building costs will probably be less important in the Cougar area than in the other study areas due to the extensive network already developed.

Observations of log loading, scaling and log storage practices were made in the Cougar area and in the industrialized areas from Longview to Woodland. There was only a small amount of woods sorting of logs in this area; this simplification makes for economical loading and trucking rates. Since woods run logs from the Cougar area are typically delivered to mills, this practice reinforces the observation that local mills can utilize a wide range of log grades. In fact, there is comparatively little cutting of logs for grade in the woods in the Cougar area. Cutting for grade and sorting out certain types of logs for rafting is usually done in the water or at the mill sites. Integration of individual mills, and the close proximity of a very wide variety of forest products manufacturers, enables maximum values to be developed from all logs hauled out of the Cougar area.

Observations of existing forest products industries using logs from the Cougar area were confined so as to avoid a needless review of the tremendous range of all wood-using plants located between Portland and Chehalis. Industries were selected as being either typical, or as having a particular bearing on the utilizing logging residues. Pulp companies were questioned about chip procurement; stud mills and dimension sawmills were inspected with particular regard to minimum log utilization standards and output efficiency. Plywood and veneer mills were queried as to log specifications and buying practices.

Obviously, the economic benefits of available water transportation (raft, barge and steamer), rail transportation and truck transportation played an important part in affecting the location of all existing mills in the Portland to Chehalis area. Both rail and steamer transportation enabled a producer to ship finished products directly to markets with a minimum of handling and transportation costs for finished products. However, the transportation of raw materials to these mills is becoming more expensive, especially as harvest cuttings are scheduled further away and at higher elevations each year. It seems appropriate at this time to examine the economic feasibility of locating a moderate capacity mill, designed to handle a large proportion of defective and low value logs, at a point closer to the growing timber than are most existing sawmills. For this reason, and because of the large volume of harvest actually cut each year around the Cougar area, the general locality of Cougar was selected in order to develop a pro forma balance sheet for several possible mill developments.

## Raw Material Buying

The raw material buying policy of one possible mill would be founded on providing a reliable and steady market for low value and so-called "cull" logs. By showing operating loggers that a near-by steady market does exist in the Cougar area for logs too poor to truck all the way to Longview, a good supply of logs might be forthcoming. The mechanics of bucking logs for residual utilization, handling small diameter logs, of trucking short lengths, of sorting out higher value specialty products and stockpiling them can be worked out by the logger. The major need is for the establishment of a mill that will use the marginal logs now left in the woods, or accidentally trucked all the way into the Longview log markets.

A compromise of existing log selling specifications in order to develop log buying standards would have to be considered for use by the possible mill at Cougar so that a profitable log mix would be supplied. Currently loggers are required to remove all logs having 50 board feet sound volume or more, and logs that are in addition more than one-third merchantable for sawing into lumber. The minimum of 50 board feet in small sound logs is not an objectionable utilization standard for most mills, if the supply is with a mixture of 80 percent or more larger diameter logs. Where a suitable mixture cannot be generated from the logging site, the proposed mill at a location near Cougar could provide a market for the surplus small logs. The mill design of a sawmill should be such that small sound logs of 20 board feet (Scribner scale) and with at least a four inch diameter on the small end, could be profitably sawn regularly. This aspect of the mill operation should be planned so as to work into the future commercial thinning programs on the Gifford Pinchot National Forest.

The log selling specification of "one-third merchantable volume" is an ineffective description, when trying to specify low value logs that can be developed from logging residues. Observation of current industry practice indicate that this wood "merchantability" may be a generally inadequate terminology in all the areas studied for this report. The specification of materials suitable for a mill designed to utilize logging residuals would have to be more definitive with regard to what is commercially valuable. For instance, a specific log with 100 board feet of sound wood useable for lumber has a basic commercial value in lumber products, but if the processing costs exceed the end product value, then that 100 board feet is actually worthless. (Such as transporting a large log with 65 percent rotten wood a long distance so that high transportation costs consume what might have been allowed for stumpage value.) Conversely, a log may have no wood in it useable for lumber, but there may be value in conversion to some other product. Consequently, the gradual development of log buying specifications for a mill in Cougar designed to utilize logging residuals would probably concentrate on the following:

Table VII

GENERAL UNIT INCOME STATEMENT FOR THE XYZ COMPANY LOCATED NEAR COUGAR, WASHINGTON, 1963

| | | |
|---|---|---|
| Chip Sales | | $12.50/unit |
| Less: | | |
| Cost of materials (50% sound logs) | $ 3.75/unit | |
| Cost of labor (six men) | 2.93 | |
| Cost of misc. expense & overhead | .60 | |
| Cost of transporting chips (40 miles, one way) | 3.75 | |
| Depreciation allowance (5 years and 20% scrap value) | .72 | |
| Total Manufacturing Cost | $11.75 | $11.75/unit |
| Gross Profit | | .75/unit |
| Less: Administrative costs | | .25/unit |
| Equals: Net Operating Profit | | $ .50/unit |

- Minimum diameter
- Minimum length
- Minimum volume in Scribner log scale
- Minimum sound chippable wood volume
- Volumes in higher grades and identification of special-use material

As a starting point, a buying specification that appears workable for a logging residue processing mill in Cougar is suggested. All logs or pieces must be at least 5 inches across, inside the bark at the small end. All logs or pieces must be at least 100 inches long between places where trimmed ends would occur, but need not necessarily be trimmed. All pieces, except those marked for special use, must contain at least 50 percent sound chippable green wood. Payments will be made for the net weight of wood unloaded at the mill weigh station near Cougar, even though this may involve a sample scaling procedure after shipments are accepted.

Using the above specification it is possible to continue the presentation of a pro forma balance sheet for a possible mill located near Cougar designed to utilize marginal logs and logging residuals. The base price that could be paid would be the market value of chips ($12.50/200 cubic foot Unit for Douglas Fir in Longview) less the hauling costs and all conversion cost for processing logs into chips (estimated in detail in the Appendix, and which total $8.75/unit), or a maximum of $3.75 per unit of solid wood input. Converted into dollars per thousand board feet gross Scribner log scale (on the basis of previously stated log buying specifications) this would be $4.68/MBF gross unloaded at a mill in Cougar.

## Chipping Plant

A chipping plant is one possible process that could utilize logging residues. A unit income statement is presented in Table VII, for a permanent chipping plant with a log yard. This generalized income statement is used to show what the various major cost breakdowns are for a simple chipping installation which may be possible to locate near Cougar.

The asset portion of the supporting balance sheet for the XYZ Company located near Cougar is shown in Table VIII.

It should be clearly understood that a mill of this nature would have to operate at 85 percent capacity for 250 days a year to attain projected income levels. Even at this optimistic projected level of income, the outlook for profit after taxes would amount to less than 6 percent on the book value of the fixed assets. Certainly this is not too bright a picture as a commercial investment or business opportunity with so many risks involved.

Even if such a mill were in operation in the Cougar area, what would be the outlook for the landowner in getting more of his logging residues utilized? The market price for 50 percent sound chippable wood would be about $4.68 per

Table VIII

ASSETS PORTION OF THE BALANCE SHEET FOR THE XYZ COMPANY LOCATED NEAR COUGAR, WASHINGTON, 1963

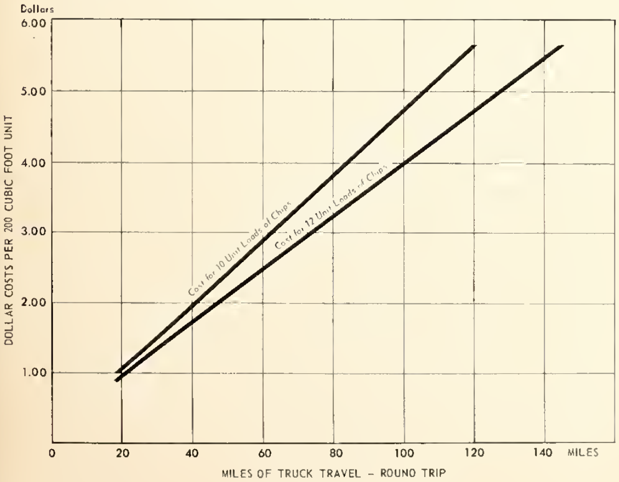
| | | |
|---|---|---|
| Current Assets: | | |
| Cash | | $16,000 |
| Inventory | | 6,000 |
| Fixed Assets: | | |
| Equipment | | 54,000 |
| Fork lift loader | 20,000 | |
| Yarder & log conveyor | 4,000 | |
| Barker | 16,000 | |
| Conveyors | 2,000 | |
| Chipper (70 units/day) | 8,000 | |
| Screens | 1,000 | |
| Bunkers | 3,000 | |
| Buildings | | 15,500 |
| Property & Storage Yard | | 6,000 |
| Total Assets | | $97,500 |

thousand board feet gross log scale in Cougar, as noted earlier. If a logger had to pay a nominal $.75 per thousand board feet gross log scale as stumpage, this means there is only $3.93 per thousand remaining for trucking costs. And since the trucking costs must be paid for on the same basis of weight hauled, whether sound, merchantable, or rotten, this means loggers can only afford to consider sites that are within a 20 mile truck haul. (See trucking cost schedules). Unfortunately, the short hauling distances mean that a great number of trips must be made each day; and this means much time spent waiting, etc. The net results are that unit costs for trucking are usually quoted higher for distances under 20 miles, and such business is small.

In fact, loggers can often find logs which are less than ⅓ merchantable (and thus qualify for the nominal stumpage rate, say $.75/HBF gross scale), but which have as much as 70 percent sound chippable wood. Pulp mills actually now are using this 70 percent chippable wood as a minimum specification in buying pulpwood. If such is to be the case in the Cougar area, a logger can net $5.00 per thousand gross scale by selling these logs directly to pulp mills. ($13.50/MBF gross delivered to the mill, less $7.75/MBF gross for log hauling costs, less $.75 stumpage). The best a logger could expect from a chipping mill located in Cougar would be only a net of $3.00 per thousand board feet gross log scale ($7.00/MBF gross for wood that is all 70 percent sound, less $4.00/MBF hauling, less $.75 stumpage).

It is apparent from this analysis, as well as from actual field observations, that a chipping mill alone cannot develop sufficient value from the raw material to clearly justify such an investment in the Cougar area. Even a portable chipping operation located right on the logging site presents no clear cut profit incentive to justify such an investment. Chipping efficiency of portable machines is lower than for stationary ones; opportunities for upgrading raw materials are less with portable chippers; there is not much difference between the cost of hauling logs for chips (on a 40-mile haul it is about $3.10/unit for transport, plus disposal costs for bark), as compared to hauling chips themselves (about $3.80/unit for a 40-mile haul); and there are still land management policies which militate against leaving refuse like bark in the woods.

ESTIMATED COST PER UNIT FOR TRUCKING CHIPS
VARIOUS LENGTH HAULS



### Chipper-Sawmill Combination

A chipper-sawmill combination is the next most promising process that might be situated in the selected Cougar locality. Chip production would still be an important function in this plant. The log buying specifications would be the same as previously quoted for the shipping mill example. In addition to buying 50% sound chippable wood, it can reasonably be expected that some sawlog and veneer bolt material will come in with the regular wood supply. Price policies and buying practices may even be adjusted to encourage this. This chipper-sawmill plant located near Cougar could develop high values from the raw materials, and would therefore help develop greater economic significance for logging residuals presently left on sites, or now processed unprofitably by distant mills not designed for such material.

The plan of operation of a chipper-sawmill combination located near Cougar would be to sort all shipments of logs in the log yard. However, all material would go through the same mill, but would probably be scheduled to make more efficient runs.

## GENERAL CONSIDERATIONS AND OBSERVATIONS

In evaluating the feasibility of utilizing logging residues, it was apparent to many foresters, loggers, mill men and truckers that there is no simple, single answer. Moreover, it is the concensus and of analytical deduction, that if a business climate were developed so that logging residues were regarded by all as an honest opportunity, then ideas would germinate into profitable business flowers. But before this pastoral scene is cultivated, there are some fieldstones that need attention.

Loggers are the first to tell of countless schemes to utilize logging residues. Maybe this is because they actually see the waste and deal with it every day. It was observed, first hand,

### CONTEMPLATED RESULTS OF COMBINATION OF A BREAKDOWN SAWMILL AND CHIPPER OPERATION LOCATED NEAR COUGAR, WASHINGTON

Predicated on processing 40 M per day—Hemlock and Pacific Silver Fir—40% Stud cants—60% screened chips.

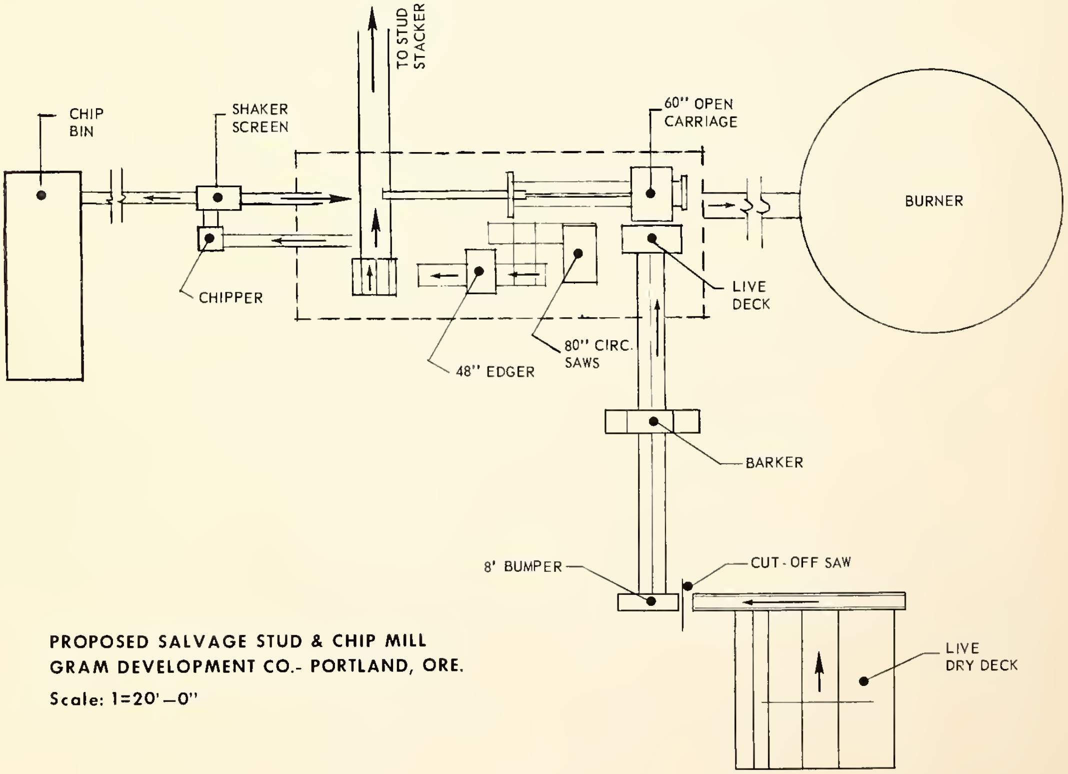
*Daily Production Costs at Mill Site*

| | |
|---|---|
| Raw Materials—40 M @ $15.00 per M | $ 600.00 |
| Labor—12 men (Av. $3.541 per Hr.) | 340.00 |
| Depreciation ($127,000—5 yrs.—10% salvage) | 115.00 |
| Administrative and office | 75.00 |
| Supplies, repairs, and maintenance | 80.00 |
| Insurance and State taxes | 32.00 |
| Power | 40.00 |
| Total per day | $1282.00 |

*Daily Income at Mill (Delivery, Costs, Deducted)*

| | |
|---|---|
| Stud cants std btr—16 M @ $36.00 | $ 576.00 |
| Hemlock & PS Fir chips—68 units @ 12.00 | 816.00 |
| Total per day | $1392.00 |
| Income per day | $1392.00 |
| Costs per day | 1282.00 |
| | $ 110.00 |

Based on 10 months per year operation, 21 days per month, 210 days x $110.00—$23,100.00 per year.



**PROPOSED SALVAGE STUD & CHIP MILL**
**GRAM DEVELOPMENT CO.- PORTLAND, ORE.**
**Scale: 1=20'–0"**

that people who do not work directly on logging jobs did not appreciate the absolute volume of sound green wood that remains on a site after logging. Even during the field measurement of logging residues, the people who helped so generously were surprised at the range of volume possible from one site to another; but were surprised more particularly at the large cubic foot volume of wood left on average logging sites.

With an average of 1,500 net cubic feet per acre observed (not accounting for the rotten volumes), it is not hard to appreciate the area of land actually covered up by these larger logs. Using rough desk calculations (logs 10 feet long, 16 inches diameter) the area covered is at least 3 percent of the total. Stumps occupy only 1 percent of the area, as a comparison. Not only do these larger logs occupy space and eliminate land from regeneration, it is observable to see how they add to the cost of handplanting—an estimated average of five dollars per acre additional cost because of logs and debris.

Cleaning up the logging sites, possibly by utilizing logging residues, would release more land for regeneration, and would reduce planting costs. Cleaner logging sites would also lower the overall risk from fire by removing the bulk of the heavy material that does burn during strong forest fires. And although no monetary value can directly be placed on the reduced risk from fire caused by more complete logging, there is some observable difference. What is to happen when States enact air pollution regulations which prevent slash burning, which is now a landowner-prescribed practice on many logging sites? Can the need for slash burning or cost of burning be reduced or eliminated by fostering cleaner logging?

Associated with the fire hazard inherent in a debris laden logging site is the added risk incurred when re-logging is proposed. If a small mobile logger feels he could economically utilize some logging residuals he must attempt this before slash burning, since most mills will not usually accept fire charred logs (especially pulp mills). However, the liability for fire prevention on the logging site usually rests with the original logger. The requirement for slash burning as a requisite for releasing the original logger from fire prevention responsibilities on the site is a strong deterrent to operators who can profitably re-log a site. Steps are being taken now to reconsider the specified slash burning policies so as to conserve good wood currently going to waste.

Critical review of present operating conditions can be a healthy exercise for management. One such review recently published that bears directly on the economics of utilizing logging residues is the General Appraisal of U. S. Forest Service Timber Appraisal Policies and Procedures; by Timber Appraisal Review Committee (Worrell, Lockwood and Lauridsen).

### PROJECTION OF VALUES AT CONCENTRATION OPERATIONS LOCATED IN PROXIMITY (10 TO 12 MILES) FROM ACTUAL LOGGING.

Based on processing 40 M (logs or equivalent)

| | | | |
|---|---|---|---|
| 40% stud cants | 16 M plus 8 units of chips | | |
| 60% chip stock | 24 M @ 2½ units—60 units of chips | | |
| Total production | 16 M. Stud cants @ $36.00 | $ 576.00 | |
| | 68 units of chips @ $12.00 | 816.00 | Per M |
| | | $1392.00 | $34.80 |
| Cost of material delivered 40 M @ $15.00 | | 600.00 | 15.00 |
| Available for all costs<br>$792.00 = 40 M or $19.80 per M | | $ 792.00 | $19.80 |
| Value of chips delivered $17.50 per unit | | | |
| Hauling costs (55 mi) | 5.50 per unit | | |
| Value at production point | $12.00 | | |
| Value of RW cants Std & Btr delivered | | $ 42.00 | |
| Cost of hauling (45 mi) | | 6.00 | |
| Value at production point | | $ 36.00 | |

Note:
Chip and cant values based on Hemlock and White Fir. If Douglas Fir is processed, the value of chips declines and the value of cants increases.

## OVERHEAD AND RELATED EXPENSES INCLUDING ADMINISTRATIVE

| | | Dollar Value | Per M |
|---|---|---|---|
| 1. For depreciation of machinery on 5 year basis with 10% salvage value. | | | |
| $2.30 per M on cants 16 @ $2.30 | $36.80 | | |
| $1.15 per M on chips 68 @ $1.15 | 78.20 | $115.00 | $2.88 |
| Based on 10 month per year operation of 21 days per month = 210 days @ $115.00 $24,150.00. | | | |
| 2. Administrative Costs | | | |
| $1.50 per M on cants 16 @ $1.50 | $24.00 | | |
| $ .75 per unit on chips 68 @ $.75 | 51.00 | $ 75.00 | $1.86 |
| 3. For supplies, repairs and maintenance (estimated) $80.00 per day 21 days per month = $1,680.00 | | $ 80.00 | $2.00 |
| 4. Insurance and state taxes estimated at $6,720.00 per year | | | $ .80 |
| 5. Power electricity estimated at $840.00 per month | | | $1.00 |
| | | | $8.54 |
| Recap: | | | |
| Based on per M-available over raw material costs | | | $19.80 |
| Direct labor costs (12 men) | $ 8.50 | | |
| Overhead, maintenance, power and administrative | 8.54 | | |
| | $17.04 | | 17.04 |
| | | | $ 2.76 |

Based on production of 840 M per month × $2.76 $2,318.40 10 month per year = $23,184.00

## ESTIMATED EQUIPMENT COSTS

| | *Equipment* | *Installation* |
|---|---|---|
| Combination yarder & bucking machine lines, saws, etc. (used) | $ 2,500.00 | |
| | 500.00 | $ 1,000.00 |
| Chains to Log Barker (approx. 30') | 1,000.00 | 1,000.00 |
| "Log Boss" Log Barker-12′ (new) | 16,000.00 | 2,500.00 |
| Chains to sawmill (approx 30′) | 1,000.00 | 1,000.00 |
| Circular breakdown sawmill motors (used) | 30,000.00 | 5,000.00 |
| Bull Edger for 2 & 4″ cants (used) | 2,500.00 | 1,000.00 |
| Live rolls & transfer rolls | 7,500.00 | 4,000.00 |
| Conveyor to chipper gear head motor | 2,000.00 | |
| | 500.00 | 1,000.00 |
| Heavy duty Chipper (70 units per day) (new) | 8,000.00 | 1,000.00 |
| Screen (new) | 3,000.00 | 1,000.00 |
| Bunker (material only) | 2,000.00 | |
| Fork and Log Lift truck carry lift 20,000# cap. | 31,000.00 | |
| Total | $107,500.00 | $19,500.00 |
| Grand Total | $107,500.00<br>19,500.00<br>$127,000.00 | |

STATISTICAL SUMMARY OF FIELD PLOTS

| *Sale* | *Cruise Vol.* | *Defect and Breakage* | *Net Cubic Volume of Residuals per acre* |
|---|---|---|---|
| Greenlookout | 24.2 | 25% | 1,602 |
| Little Pelvy | 41.9 | 25 | 4,264 |
| East Fork | 38.0 | 20 | 1,512 |
| White Bluff | 44.8 | 14 | 328 |
| Lake Creek | 62.0 | 30 | 1,076 |
| Timonion | 48.2 | 45 | 316 |
| Dixon Mt. | 61.0 | 90 | 1,404 |
| Long Lake | 90.0 | 30 | 3,664 |
| Average | 51.3 | 35 | 1,771 |

Sample Standard Deviation

$$s_X = \sqrt{\frac{X^2 - nX^2}{n - 1}} = \sqrt{\frac{39{,}475{,}400 - 8(3{,}136{,}441)}{7}}$$

$$= \sqrt{\frac{14{,}383{,}872}{7}} = \sqrt{2{,}054{,}773} = 1{,}434$$

Therefore: The standard deviation of the *sample mean* $= \frac{s}{x} = \frac{s_X}{n}$

$$\frac{1{,}434}{8} = 615$$

The Confidence Interval for a 90% Confidence Coefficient is

$$CI = X \pm t_n - 1) s_X = 1771 \pm (1.895)\ 615$$

$$CI = 2{,}936 \text{ to } 606$$

For a sample plot taken in typical areas of logging you can expect the average volume per acre to be between 2,936 and 606 for 90% of the time.

Though appraisal techniques and methodology in general are beyond the scope of this study, applications of the results of some appraisal regarding the logging residual portion of timber is one of the objects of the study. As illustrated in the text for all four areas, there is no clearly feasible utilization scheme for profitably processing logging residues. As noted with particular regard to the Cougar area, it may be possible for the right person to slowly arrange a mutually beneficial situation to utilize some logging residues. In all cases it will usually take the active interest and cooperation of both buyer and seller to work out a satisfactory business. It should be fully appreciated that in this particular case of utilizing logging residues, without buyer there cannot be the seller, and vice versa. This mutual interdependence was noted to be a needed objective as one conclusion in the General Appraisal of Forest Service Policies report cited above. From first-hand field observation, this spirit of mutual cooperation and aggressive co-development does need implementation throughout the study area if ever logging residues are to be profitably utilized.

One development that could accelerate the utilization of logging residues that deserves considered attention is the lump sum method of selling timber. This method, as practiced by the Bureau of Land Management and others, would not change the basic appraisal procedure. A lump sum sale involves an appraisal of the

MAN POWER REQUIRED

| | | | |
|---|---|---|---|
| 1 | General Foreman | $ 5.00 | per hour |
| 1 | Fork lift | 3.50 | per hour |
| 1 | Log Man | 3.00 | per hour |
| 1 | Barker Operator | 4.00 | per hour |
| 1 | Helper | 3.00 | per hour |
| 1 | Sawyer | 4.00 | per hour |
| 1 | Offbearer | 3.00 | per hour |
| 1 | Edgerman | 4.00 | per hour |
| 1 | Offbearer | 3.00 | per hour |
| 1 | Millwright | 4.00 | per hour |
| 2 | Laborers | 6.00 | per hour |
| 12 men | total | $42.50 @ 8 hours = $340.00 per day | |

40 M = $340.00 or $8.50 per M

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timber content of the property, the development of an estimated minimum average price per unit, and an acceptable lump sum value of the timber on the property. Through competitive bidding buyers can vie for exclusive cutting rights. Once the contract is awarded to the highest qualified bidder, he has the entire incentive to remove as much volume from the sale as is economically possible so as to, first, reduce his average cost per unit for the sale; and, secondly, he can continue to remove any and all material in addition so long as his direct costs of operation are covered by the return from each product. Material is presented to document that lump sum selling of timber can result in cleaner logging sites, and that other economists feel that the key issue of economic incentive is better served in most cases by lump sum selling methods than by current timber sales practices of the Forest Service. In addition, sale preparation, administration efforts and costs will be minimized by this simpler selling technique so that other duties necessitated by a developing multiple use program can be accomplished with the same staff.

Another development that could accelerate the utilization of logging residues is the charging for stumpage on the basis of a count of manufactured product output. This arrangement would work best when National Forest timber is the only source of material. The outcome would be to avoid putting such a premium on destroying material in the woods so as to avoid having to take economically less desirable types of logs. The flat rate at which stumpage would be paid would have to be negotiated.

## SUMMARY OF METHOD OF SAMPLING USED IN MAKING FIELD PLOTS

Utilization standards used were to measure all sound material in all logs and chunks down to a 6 inch minimum diameter and an 8 foot minimum length. Exception to this was when material was over 12 inches in diameter and was peelable, then a 54 inch length was used.

Selection of areas was decided upon with counsel from the District Forester and staff as to the areas that were typical of logging in the area. Also needed were areas that had not been burned for slash, that did not have pulpwood removed, that were on modestly sloping topography (less than 40 percent slope).

Establishing the ½ acre field plot was done in the field. A point not on a ridge, or in a gully, was chosen half way between the spar pole and the outer limit of logging.

Measurements taken were both end diameters inside bark. Length was taken to an area where an approximate circular cross-section would occur (but not necessarily without splits or cracks). Logs slightly cracked in half were measured as one long log with no deduction for the break.

**U.S. DEPARTMENT OF COMMERCE**
**Luther H. Hodges, Secretary**

**AREA REDEVELOPMENT ADMINISTRATION**
**William L. Batt, Jr., Administrator**
**OFFICE OF PLANNING AND RESEARCH**
**Gordon E. Reckord, Asst. Administrator**

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